

5 A Day Behavior Change Research in Children and Adolescents

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INTRODUCTION

Vegetable and fruit consumption has been linked to reduced risk for various forms of cancer (Steinmetz and Potter, 1996). However, vegetable and fruit consumption tends to be low in children and adolescents. Estimates indicate that only 6.8 to 27.7 percent of children eat five or more servings of vegetables and fruit per day as recommended by the National Cancer Institute (NCI) and other national health organizations (Kann et al., 1996; Basch et al., 1994; Krebs-Smith et al., 1996). High school students and other adolescents consume about 2.6 servings of vegetables and fruit per day (Nicklas et al., 1998; Beech et al., 1999).

Substantial evidence indicates that risk factors and risk behaviors present in youth track into later childhood and early adulthood (Nicklas et al., 1995; Perry et al., 1994; Webber et al., 1991; Berenson et al., 1991; Porkka et al., 1991; Clarke et al., 1978). Longitudinal data supporting the tracking of behaviors in youth are limited; however, several studies have identified the tracking of dietary behaviors in youth (Kelder et al., 1994; Stein et al., 1991; Nicklas et al., 1998). Because consumption of vegetables and fruit is low among youth and adolescents, and because dietary behavior developed in childhood may track into adulthood, interventions to increase vegetable

and fruit consumption in children and adolescents are important and might help reduce cancer risk. School-based dietary interventions help children and adolescents form positive health behaviors that may last into adulthood, reducing disease risk for many years.

Intervention research conducted in the schools has its difficulties (e.g., the lack of cooperation of teachers, limited availability of class time). However, a number of advantages can be seen for school-based intervention research on vegetable and fruit consumption. More than 95 percent of children 5 to 17 years of age are enrolled in school, making schools a good setting to reach children and adolescents with health promotion programs (Kann et al., 1995), including programs to increase vegetable and fruit consumption. Because a wide range of children and adolescents attend school, traditionally hard-to-reach groups also can benefit from health promotion and disease prevention programs through this setting (Kirby and DiClemente, 1994). In addition, regular visits to schools provide health promoters with repeated access to children and adolescents and enable repeated exposure to intervention activities. Complex interventions can be developed that repeat key messages, building from

activities that target knowledge and attitude change to more intensive activities that include behavioral skills-building, goal-setting, and self-monitoring. Repeated access to students also enhances research and evaluation, thereby allowing for completion of followup assessments (Reynolds et al., 1999).

The school setting provides opportunities for introducing environmental modifications that sustain long-term changes in vegetable and fruit consumption well after the delivery of a curriculum or other nonenvironmental intervention. To support dietary change, school policies can be modified, teachers and other personnel can be trained, and changes in the physical environment can be made. If sustained, the environmental changes support the positive health behavior of succeeding student generations. Schools also can provide access to families, with recruited children and adolescents serving as links to their parents and siblings. This can multiply the efforts of the health promotion team by changing the parents' and siblings' behaviors, reducing their disease risk as well as creating a home environment that is supportive of dietary change in the recruited student. These reasons all support the development, implementation, and evaluation of school-based interventions to increase the vegetable and fruit consumption of children and adolescents.

This chapter will provide a review of the school-based intervention research funded under NCI's 5 A Day for Better Health Program. This chapter does not constitute an exhaustive review of all school-based efforts to increase vegetable and fruit consumption. The five intervention projects are described, and brief descriptions of the evaluation design for each project are given. Reports summarizing each project's effect on vegetable and fruit consumption also are included. The experience of the 5 A Day investigators and the lessons learned from these prevention studies will be instructive to those interested in mounting effective school-based dietary intervention, cancer prevention programs.

OVERVIEW OF SCHOOL-BASED INTERVENTION PROGRAMS

Lead Agencies and Collaborative Relationships

The intervention approach used by each 5 A Day school-based research site is summarized in

Table 1. In three of the five sites (Alabama, Georgia, and Louisiana), a university-based research group provided the overall project leadership. In Minnesota, there was close collaboration between the Minnesota Department of Health and the University of Minnesota in designing and executing the project. Investigators were drawn from both agencies, with the principal investigator based at the Minnesota Department of Health. In California, the project effort was led by the California Department of Health Services. The California project received less money, and was funded for a shorter duration and through a different mechanism, than were the other projects discussed in this chapter. Therefore, it is the only project without a randomized design.

Each 5 A Day project maintained extensive relationships with community organizations (e.g., the Alabama Division of the American Cancer Society; Hoover, Alabama, city schools) that were stakeholders in the goal of increasing child and adolescent consumption of vegetables and fruit. These stakeholder organizations provided credibility and support for the projects in the larger health community and served on the advisory boards for several projects. The most important collaborative relationships were those between the 5 A Day Program and the participating school districts in their area. The participation of these districts was essential for the success of each project, including the recruitment of schools and participating families, delivery of intervention activities, completion of outcome measures, and development and pilot-testing of intervention strategies. School personnel often served on the steering or advisory committees for the projects and, in some cases, as project investigators. The identification and selection of key school personnel to serve as collaborators on the projects facilitated access to the schools and greatly enhanced the design process for the interventions, helping to ensure their utility in the school environment.

Description of the Intervention Projects

Four projects targeted elementary school students in grades 4 and 5 (Alabama, California, Georgia, and Minnesota) while one site (Louisiana) targeted high school students. For detailed descriptions of each program, see Baranowski and colleagues, (2000); Foerster and colleagues (1998); Nicklas (1997); Perry and colleagues (1998); and Reynolds and colleagues (1998).

Table 1. Project Summaries

<i>Project Name</i>	<i>Lead Agencies</i>	<i>Target Groups</i>	<i>Intervention Elements</i>	<i>Theories Used in Intervention</i>	<i>Community Collaborators</i>
5 A Day Power Plus (Minnesota)	<ul style="list-style-type: none"> • Minnesota Department of Health • University of Minnesota 	Fourth- and fifth-graders	<ul style="list-style-type: none"> • Classroom activities • Parent involvement • School food service • Industry involvement 	Social Cognitive Theory	<ul style="list-style-type: none"> • St. Paul public schools • Minnesota 5 A Day Coalition
5 A Day—Power Play! (California)	<ul style="list-style-type: none"> • California Department of Health Services 	Fourth- and fifth-graders	Social marketing approach with <ul style="list-style-type: none"> • Schools • Supermarkets • Farmers markets • Mass media • Community youth organizations 	Resiliency Theory Reciprocal Determinism	<ul style="list-style-type: none"> • Alisal Union School District • Salinas City School District • San Diego Unified School District • Salinas Community Organizations
Gimme 5: Fruits and Vegetables for Fun and Health (Georgia)	<ul style="list-style-type: none"> • Emory University 	Fourth- and fifth-graders	<ul style="list-style-type: none"> • Classroom activities • Parent involvement • Point-of-purchase education 	Social Cognitive Theory	<ul style="list-style-type: none"> • Gwinnett County, Georgia, Board of Education • Atlanta public schools
Gimme 5: A Fresh Nutrition Concept for Students (Louisiana)	<ul style="list-style-type: none"> • Tulane University School of Public Health 	High school students	<ul style="list-style-type: none"> • School media marketing campaign • School meal modification • Classroom activities • Parent involvement 	PRECEDE-PROCEED Model	<ul style="list-style-type: none"> • Archdiocese of New Orleans • Fruit and vegetable commodity groups
High 5 (Alabama)	<ul style="list-style-type: none"> • University of Alabama at Birmingham 	Fourth-graders	<ul style="list-style-type: none"> • Classroom component • Cafeteria component • Parent component 	Social Cognitive Theory Social psychological theories	<ul style="list-style-type: none"> • Bessemer Board of Education • Hoover City Schools • Jefferson County Board of Education

The interventions at each site were developed using an organizing theoretical model or set of models (see Chapter 8 and Appendix D). Social Cognitive Theory (Bandura, 1986) had been used successfully in numerous school-based interventions and was used by four of the 5 A Day projects (Alabama, California, Georgia, and Minnesota). Louisiana's project used the PRECEDE-PROCEED Model to organize intervention activities, while also employing social marketing strategies and stages of change in some elements of its intervention. In the design of its intervention, the California project used social marketing approaches with the Resiliency Theory (Garmenzy, 1991; Thompson and Daugherty, 1984) and Reciprocal Determinism, a component of Social Cognitive Theory. The use of organizing theories allowed investigators to

focus intervention strategies on factors that would lead to the modification of eating behavior, making these theory-based interventions more powerful than interventions developed without the use of a guiding theory (Contento et al., 1995).

Although the specific intervention components varied among projects, most shared three elements in their interventions: 1) a classroom curriculum, 2) modification of school food-service activities, and 3) parent or family involvement. Most of the projects solicited the participation of vegetable and fruit commodity groups to assist with some aspect of the intervention. Together, these components attempted to change the motivation, skills, and behavior of the individuals and tried to transform the family and school environments that support behavior

modification in the individuals. A more extensive intervention description is supplied for each project below.

5 A Day Power Plus (Minnesota)

Design Overview

The Minnesota 5 A Day Power Plus study (Perry et al., 1998) was a randomized trial with more than 1,700 students in 20 schools matched on size, percentage of students receiving free or reduced-price lunches (an indicator of socioeconomic status), and ethnic makeup of the student population. Schools were paired and randomly assigned to intervention or control conditions. Schools were the unit of analysis. Baseline data were collected from fourth-grade students during January and February 1995. The fourth-grade intervention took place during March through May 1995. Those same students received the second half of the intervention as fifth-graders during October 1995 through January 1996. Followup data were collected during late January through March 1996 following the conclusion of the intervention. The impact of the program was assessed using the following methods: 1) observations of student intake at lunch to assess vegetable and fruit consumption; 2) food-record-assisted 24-hour dietary recall; 3) a student health behavior questionnaire administered in the classroom to assess psychosocial factors related to consumption; and 4) a telephone survey of parents to assess home availability of vegetables and fruit, as well as parent consumption, parenting practices, and attitudes toward vegetable and fruit consumption. In addition, the project used extensive process evaluation to assess the degree to which the intervention was implemented as intended, the attitudes of teachers and food-service staff toward vegetables and fruit, and the level of student exposure to competing programs that might have affected the results. Table 2 provides a summary of the evaluation designs for all five State programs.

Use of Theory in Intervention Design

The Power Plus project followed a model of youth health promotion derived from both Social Cognitive Theory (Parcel et al., 1999; Bandura, 1977; Bandura, 1986; Perry and Jessor, 1985) and prior research in changing children's dietary behavior (Lytle and Achterberg, 1993; Luepker et

al., 1996; Perry et al., 1997). The intervention targeted psychosocial factors hypothesized to be both predictive of children's eating habits and amenable to change (Perry et al., 1997). Table 3 illustrates the use of theory in intervention design for all five State programs. Major components of Social Cognitive Theory and examples of their application included the following:

- **Environment** (social support from peers, teachers, and food-service staff, as well as expanded opportunities to eat vegetables and fruit in the school cafeteria);
- **Self-efficacy/behavioral capability** (skills training in preparation of, and asking for, vegetables and fruit);
- **Outcome expectations/observational learning** (new role models using cartoon mascots and comic strips to increase vegetable and fruit consumption);
- **Self-control** (setting goals and self-monitoring of vegetable and fruit consumption); and
- **Reinforcement** (incentives and rewards for eating vegetables and fruit).

Intervention Description

The intervention consisted of four components: 1) classroom curricula, 2) parental involvement and education, 3) school food-service changes, and 4) industry support. For the classroom, curricula were written for the fourth grade (High 5) and for the fifth grade (5 for 5). Sixteen 40- to 45-minute classroom sessions were included for each curriculum, and these were implemented twice a week for 8 weeks. The curricula included skills-building and problemsolving activities as well as snack preparation and taste-testing. These materials also introduced new role models: vegetable and fruit cartoon characters (High 5) and Olympic athletes (5 for 5). The fourth-grade curriculum featured the High 5 Flyers, a team of vegetable and fruit cartoon characters with names like the Juicester, Go Go Grape, and the Green Machine. The fifth-grade curriculum included a serial adventure in which students tried to solve the mystery of missing vegetables and fruit at the 1996 Olympic training camps. Students formed teams during both curricula, and team competition to eat more vegetables and fruit during lunch was a central activity in both grades. Students received points for vegetables and fruit eaten at lunch and small prizes on both an

Table 2. Evaluation Designs

<i>Project Name</i>	<i>Evaluation Design</i>	<i>Measures</i>	<i>Measurement Periods</i>	<i>Number of Participants</i>	<i>Age, Gender, Ethnicity</i>
5 A Day Power Plus (Minnesota)	Schools randomly assigned to conditions: intervention vs. control	<ul style="list-style-type: none"> • 24-hour diet recall • Cafeteria observation • Psychosocial questionnaire • Parent telephone survey 	Baseline 1 year post-baseline	20 schools 1,750 students	Age = 10.0 years Female = 50% White = 48% Hispanic = 6% Asian = 25% African-American = 19% Other = 2%
5 A Day Power Play! (California)	Schools assigned to conditions: school only vs. school plus community vs. control	<ul style="list-style-type: none"> • 24-hour food diary • Psychosocial questionnaire 	Pretests and posttests for an 8-week intervention in late winter/early spring 1995	49 schools 2,684 students	Age ¹ Female = 50% Fourth-grade = 44% Fifth-grade = 51% English spoken in home = 63%
Gimme 5 (Georgia)	Schools randomly assigned to conditions: intervention vs. control	<ul style="list-style-type: none"> • 7-day food record • Psychosocial questionnaire • Telephone interviews with parents 	Annual in late February to early March Completed in grades 3 through 5	16 schools 1,946 students	Age = 8.7 years Female = 50% White = 79% Hispanic = 1% Asian = 2% African-American = 16% Other = 2%
Gimme 5 (Louisiana)	Schools randomly assigned to conditions: intervention vs. control	<ul style="list-style-type: none"> • 24-hour diet recall • Psychosocial questionnaire • Self-report questionnaire • Outcome measures for school environment 	Baseline 1 year postbaseline 2 years postbaseline	12 schools 2,213 students	Age = 14.8 years Female = 56% White = 84% Hispanic = 9% African-American = 4% Other = 3%
High 5 (Alabama)	Schools randomly assigned to conditions: intervention vs. control	<ul style="list-style-type: none"> • 24-hour diet recall • Block food frequency questionnaire (parents) • Cafeteria observation of consumption (students) • Psychosocial questionnaire 	Baseline 1 year postbaseline 2 years postbaseline	28 schools 1,698 students 1,308 parents	Age = 8.7 years Female = 50% White = 83% African-American = 16% Other = 1%

¹ Grade rather than age was the target characteristic of interest.

individual and team basis. All fourth- and fifth-grade teachers completed a 1-day training session prior to implementing the curricula.

The parental involvement program for the fourth grade was a modification of the home team approach developed by Perry and colleagues at the University of Minnesota (Perry et al., 1988) and consisted of five informational and activity packets brought home by the students to share with their parents. The fifth-grade parent component consisted

of four snack packs brought home by the students. Snack packs were assembled by the school food service and included food industry donations. The snack items were those prepared in class by students on the same day so that students could acquire the skills to make these snacks for their families.

The food-service intervention was designed to encourage selection and consumption of vegetables and fruit at school lunch and to reinforce lessons in consumption learned at home and in the classroom.

Table 3. Use of Theory for Intervention Design

Project Name	Elements of the Theory	Examples of Use in the Classroom Component	Examples of Use in the Family Component	Examples of Use in the Environmental or Community Component
5 A Day Power Plus (Minnesota)	<i>Social Cognitive Theory</i> : environment, behavioral capability, outcome expectations, goal-setting, self-monitoring, observational learning, reinforcement, self-efficacy	<ul style="list-style-type: none"> • Role models created to provide vegetable and fruit messages • Skills development through food preparation 	<ul style="list-style-type: none"> • Rewards for participation in the home team • Family goal-setting concerning vegetables and fruit 	<ul style="list-style-type: none"> • Food service: increased quantity and choice of vegetables and fruit • Industry spokesman presented in all classrooms
5 A Day Power Play! (California)	Social marketing approaches using <i>Resiliency Theory</i> and <i>Reciprocal Determinism</i> : knowledge, affect, skills, norms, bonding and belonging, reward and recognition, environment	<ul style="list-style-type: none"> • Knowledge: Message on all materials to "Eat 5 A Day!" • Norms: Power Passport (2-week diary) where child observes own vegetable and fruit consumption and that of peers 	<ul style="list-style-type: none"> • (Bonding/belonging, skills, norms) survey power: child surveys family about vegetable and fruit consumption, preferences • Environment: vegetables and fruit available for child 	<ul style="list-style-type: none"> • Environment: "Health Bites" public service announcements • Environment, bonding, skills, norms: Supermarket Sleuth grocery store tours
Gimme 5: Fruits and Vegetables for Fun and Health (Georgia)	See list for <i>Social Cognitive Theory</i> , above	<ul style="list-style-type: none"> • Activities to increase self-efficacy in asking for vegetables and fruit • Goal-setting to increase vegetables and fruit at specific meals 	<ul style="list-style-type: none"> • Parent helps child make vegetable and fruit recipes • Parent confirms goals reached at home 	<ul style="list-style-type: none"> • Demonstration by produce manager to enhance self-selection of vegetables and fruit
Gimme 5: A Fresh Nutrition Concept for Students (Louisiana)	<i>PRECEDE-PROCEED Model</i>	<ul style="list-style-type: none"> • Workshops and supplemental subject activities to build skills 	<ul style="list-style-type: none"> • Parent-Teacher Organization meetings with media and activities to build skills • Gimme 5 column in school newspaper to build skills 	<ul style="list-style-type: none"> • Taste-testing and marketing stations to build awareness • Incentives to operationalize reinforcement
High 5 (Alabama)	See list for <i>Social Cognitive Theory</i> , above	<ul style="list-style-type: none"> • Behavioral capability built by modeling and teaching skills for preparing vegetables and fruit • Reinforcement achieved through individual and class rewards for reaching goals 	<ul style="list-style-type: none"> • Families asked to set goals as a part of the homework exercises • Simple self-monitoring tools used to follow vegetable and fruit progress at home 	<ul style="list-style-type: none"> • Food-service workers' skills increased for purchasing, preparing, and promoting vegetables and fruit • Posters, 5 A Day logo aprons, and labeling of vegetables and fruit in cafeteria used to trigger consumption and modify norms

This component included point-of-purchase promotions using characters and messages from the classroom curricula, enhanced attractiveness of vegetables and fruit served at lunch, and an increased variety and choice of vegetables and fruit available to the

students. The food-service staff participated in a 2-hour training session before each curriculum.

The industry support component strengthened the community connection by providing linkage to the Minnesota 5 A Day Coalition, a licensed

participant in NCI's 5 A Day Program. One industry member gave classroom presentations and provided vegetables and fruit for classroom taste-testing, home snack packs, and school lunches. Other partners developed and printed posters for the lunchroom and provided educational and incentive materials for the home packets.

Students and teachers rated the taste-testing in the classroom and the cartoon role models as the most popular and effective part of the curricula. The parent component appeared to be the weakest part of the program. In part, this may have been due to a large migrant population in which more than 20 percent of the parents were unable to speak English. Changes in vegetable and fruit consumption occurred almost entirely at school lunch and not at home. Teachers and staff rated the program highly and indicated that they would continue to offer the program if given the opportunity to do so. In fact, the St. Paul School District has continued the program in the 2 years since the intervention's conclusion, though in a more abbreviated format without the fifth-grade curriculum.

5 a Day—Power Play! (California)

Design Overview

The study used a nonrandomized design to determine the effectiveness of offering the Power Play intervention in schools only or through a communitywide public health approach, as compared with a control community in which no intervention was offered (school only versus school plus community versus control) (Foerster et al., 1998). The study sample involved more than 2,600 fourth- and fifth-graders attending 49 public schools in three geographically distinct communities. Fifteen schools and 1,077 children participated in the school-plus-community condition, 19 schools and 845 children in the school-only condition, and 15 schools and 762 children in the control condition. Schools in the same community tended to be in the same condition. The children participated in Power Play! activities during an 8-week intervention period in the late winter and early spring of 1995. They completed 24-hour food diaries and survey questions before and after the intervention. Food diaries were analyzed for vegetable and fruit consumption. Survey questions addressed attitudinal variables

based on the seven behavioral change constructs that the Power Play! program uses (see next section). Measures for skills included children's survey queries, such as, "I think I can ask school staff for fruits and vegetables (agree/disagree)." Measures for norms included such queries as, "My friends will make fun of me if I eat fruits and vegetables every day (agree/disagree)." Environment measures included children's survey queries, such as, "I think I can find fruits and vegetables at the school cafeteria (agree/disagree)." These measures also included school site observations for qualitative assessment. The evaluation framework included process measures for adult intermediaries that incorporated the seven behavioral change variables.

Use of Theory in Intervention Design

Power Play! is a social marketing program that works through five communications channels: schools, supermarkets, farmers' markets, community youth organizations, and media. Power Play! was based on seven behavioral change constructs that interact and change one another over time. This principle is known as Reciprocal Determinism, which originated from Resiliency Theory and Social Cognitive Theory (Bandura, 1986) (see Appendix D). The seven behavioral change constructs nested in the design of the Power Play! intervention and evaluation design are knowledge, affect, skills, norms, bonding and belonging, reward and recognition, and environment. Each of the Power Play! activities is intended to promote vegetable and fruit consumption by framing it within one or more of these constructs. For example, one Power Play! activity is the mini-salad bar, and it incorporates the behavioral change constructs of skills (through students learning to identify new foods) and norms (through students observing their peers eating and enjoying vegetables and fruit). The activity occurs in the school or cafeteria environment, providing an opportunity to foster vegetable and fruit consumption.

Intervention Description

Teachers conducted 10 of 14 selected activities over 8 weeks in the school-only and school-plus-community conditions. In the school-plus-community intervention, activities also occurred in five local supermarkets, at farmers markets, on local television, and with two community youth organ-

izations. In addition, a special community event, Power Play! Day, was held.

In schools, teachers and food-service directors conducted at least 10 activities covering a range of behavioral change constructs. The activities included developing secret snack pals, making fruit kabobs, doing word scrambles of vegetable and fruit names, keeping a 2-week diary of vegetable and fruit consumption, making advertisements for vegetables and fruit, taste-testing, designing a meal for the school cafeteria, and singing or dancing to a 5 A Day rap song.

In the school-plus-community interventions, community youth groups conducted similar kinds of activities. The supermarkets gave store tours to students, placed Power Play! posters and other point-of-sale promotional materials in the produce department, printed Power Play! activities on grocery bags, and sponsored Power Play! art contests. The local farmers market donated produce to the schools, put up Power Play! signs, and held special games and contests for children during market hours. Two local television stations aired Power Play! public service announcements, called "Health Bites," during children's viewing hours. A special event called Power Play! Day was held for students and their families at one of the school gymnasiums, with vegetable and fruit games and contests, as well as recipe-tastings. The recipes were developed by one fourth- or fifth-grade class from each participating school, with guidance from a produce industry sponsor.

At the completion of the study, a press conference was held by the California Department of Health Services in a school gymnasium within the school-plus-community region to announce the study results and to recognize the contributions of the many community partners. The study results also facilitated securing a \$5 million grant from The California Endowment in order to implement Power Play! statewide.

Gimme 5: Fruits and Vegetables for Fun and Health (Georgia)

Design Overview

The Gimme 5 project in Georgia used a longitudinal design, with schools as the units of selection, assignment, and analysis. More than 1,900 students in 16 elementary schools were recruited (12 in a suburban county district and 4 in a central city dis-

trict). Within a district, schools were matched on size, on percentage of free and reduced-price lunches served (an indicator of socioeconomic status), and on percentage of annual student turnover. Schools were then randomly assigned within pairs to intervention and control conditions. A baseline assessment was conducted among participating third-grade children during late February and early March 1994. Mid-program assessment was conducted with all students following the completion of the 6-week fourth-grade program during late February and early March 1995. Post-program assessment was conducted by school staff with all the students at the same time in 1996. Outcome analyses were conducted both with all students available for each year and with the cohort of students who had data available for all 3 years. (The results were virtually identical between methods.) The primary outcome measure was obtained from a prompted 7-day food record (Domel et al., 1994) using behavioral coding (Cullen et al., 1999). Psychosocial variables included vegetable and fruit preferences, outcome expectancies, self-efficacy, and social norms. There were interviews with 13 randomly selected parents per school at each data collection time. Parent interviews assessed the availability and accessibility of vegetables and fruit and evaluated the program process.

Use of Theory in Intervention Design

Consistent with the concept of Reciprocal Determinism, formative evaluation revealed that the reasons children were not eating enough vegetables and fruit were environmental (low availability and accessibility at home, especially among children from low-income families), personal (low preference for vegetables), and behavioral (low skills in making vegetable and/or fruit recipes). Based on Social Cognitive Theory, the intervention attempted to train students in asking behaviors and food preparation (thereby enhancing both skills and self-efficacy) and to enhance the children's preferences both through association with fun activities and through exposure to the target foods and recipes. Also, the self-control procedures of goal setting, self-monitoring, decisionmaking, problemsolving, and rewards were applied to different dietary behaviors each week.

Intervention Description

The Gimme 5 curriculum encouraged and assisted fourth- and fifth-grade students to eat more

servings of vegetables and fruit by: 1) increasing their availability and accessibility at home and at fast-food restaurants through role-playing to develop student asking skills; 2) enhancing students' preferences for vegetables and fruit by strongly encouraging students to taste the fast, simple, safe, and tasty (FaSST) recipes prepared in class; 3) training students in FaSST vegetable and fruit preparation to increase their snack and meal preparation skills; 4) training in goal setting to mobilize skills to increase intake; and 5) enhancing problemsolving skills. Students earned points toward a small prize for attaining dietary goals. The fourth-grade curriculum targeted vegetable consumption alone, while the fifth-grade curriculum emphasized fruit but included vegetables in order to achieve the goal of five servings of vegetables and fruit a day.

Family involvement activities included distributing *Gimme 5 Daily* newsletters to take home to parents every week, providing suggestions and recipes for increasing vegetable and fruit intake, and involving the family in weekly home assignments. These home assignments were designed to train students to prepare FaSST vegetable and fruit recipes under parental supervision, to encourage students to make more vegetable and fruit selections at fast-food restaurants, and to increase the availability and accessibility of vegetables and fruit at home. For each grade level, three MTV-like videotapes, each 10 to 14 minutes long, were sent to parents at 2-week intervals. The videotape content paralleled the Gimme 5 curriculum, emphasizing modeling of desired behaviors.

Point-of-purchase education efforts were conducted each year at grocery stores that parents most frequented with two grocery stores near each intervention site conducting the education efforts. The produce managers presented a family night at which they provided suggestions for selecting, storing, and preparing inexpensive fresh vegetables and fruit; conducted taste-testings of fresh vegetables and fruit; and distributed vegetable and fruit recipes.

Gimme 5: A Fresh Nutrition Concept for Students (Louisiana)

Design Overview

Twelve high schools in the Archdiocese of New Orleans school system participated in this 4-year

study (Nicklas et al., 1998). A paired design, matched on gender, ethnicity, school enrollment, and general geographic location, was used to randomly assign the 12 schools (6 pairs) to intervention or control conditions. The six school pairs were three female, two male, and one coeducational. One school in each pair was randomly assigned to receive the Gimme 5 measurement and intervention, while the other schools—the control condition—received the Gimme 5 measurement only. The intervention was longitudinal, following a cohort of students from the 9th through 12th grades. The cohort was defined as students who were enrolled in participating schools at the time of the baseline measurement and who completed the knowledge, attitudes, and practices questionnaires (spring of 1994). A cohort of 2,213 students (56 percent female, 84 percent White, 9 percent Hispanic, 4 percent Black, and 3 percent other), representing 95 percent of the eligible students, was identified at the baseline. At followup, 81 percent of the cohort had participated in the Gimme 5 measurement and intervention, and an additional 15 percent had participated during 3 of the 4 years. No significant differences according to participation by group assignment, gender, or ethnicity occurred at followup.

Use of Theory in Intervention Design

Consistent with Social Cognitive Theory, the specific components of the Gimme 5 project addressed the following levels of behavior change: 1) awareness development and interest stimulation, 2) information transfer and skills training, 3) reinforcement, and 4) application and maintenance. Awareness development and interest stimulation were primarily addressed through the schoolwide media-marketing materials that implemented cafeteria taste-testings and food giveaways. The components of information transfer, skills training, application, and maintenance were addressed both in the classroom workshops and by the supplemental subject activities delivered to the students. These components were supported further through the information received by parents in the school newspapers or the *Gimme 5 Alive* newsletter. Reinforcement activities included taste-testings, food giveaways, incentives, coupons, and student contests.

Intervention Description

Intervention components included the following: 1) a schoolwide media-marketing campaign,

2) classroom activities, 3) school meal modification (Fresh Choices), and 4) parental involvement (Raisin Teens). The schoolwide media-marketing campaign was the major intervention strategy for delivering the 5 A Day message to students. The goal was to provide appealing messages and activities that would increase awareness, reinforce concepts, and promote positive attitudes toward consumption of vegetables and fruit. All media channels were coordinated to support monthly themes designed to stimulate and maintain student interest. Media materials and activities used in the monthly promotions included: 1) marketing stations consisting of large cafeteria displays that showed 5 A Day messages consistent with the monthly themes and that promoted Gimme 5 events and promotional material; 2) monthly taste-testings; 3) point-of-service signs with nutrient information on vegetables and fruit; 4) posters; 5) table tents with 5 A Day messages and events; 6) schoolwide public service announcements; 7) faculty vegetable and fruit baskets that were distributed each semester; 8) faculty tip sheets on 5 A Day; and 9) student contests in the cafeteria that promoted peer leadership and stimulated student interaction.

The classroom activities included five 55-minute workshops and a variety of learning strategies. These workshops gave students the opportunity to develop the knowledge, attitudes, and skills necessary to increase vegetable and fruit consumption. Each workshop was designed to meet specific learning objectives that related to a theme (e.g., Fast Food—Go for the Green). The workshops were implemented by a Gimme 5 health educator or by designated school personnel trained by the Gimme 5 health educator. In addition to the workshops, supplementary subject activities were included in required academic courses, using vegetables and fruit in the lesson design. Each ninth-grade teacher was requested to teach at least one supplementary subject activity every semester during the first year of the intervention.

The school meal modification component sought to improve in the cafeteria the availability, variety, and taste of vegetables and fruit meeting the 5 A Day criteria. The school food-service staff was trained, and supplementary materials were provided. Cyclical menus developed by the school system were modified during the first year and incorporated the monthly vegetables and fruit, or the ethnic menu, being promoted. A *Fresh Choices*

School Meal Program Guide was designed for use in the high school cafeterias by the food-service personnel, and they were trained in its use. The manual contained guidelines to assist cafeteria staff in menu and recipe modification, food purchasing, food preparation, and food promotion.

The parental involvement component sought to stimulate awareness, elicit parental support of the Gimme 5 project, and increase the availability and variety of vegetables and fruit in the home. Taste-testings, media displays, and other activities were provided at Parent-Teacher Organization meetings and at other family-related functions. Brochures with recipes, purchasing tips, and nutritional information were distributed to parents via school mailings. In addition, a *Gimme 5 Alive* newsletter was sent to parents each semester to provide information on Gimme 5 activities, recipes, discount coupons for produce, and the benefits and uses of vegetables and fruit. School newspapers also featured a Gimme 5 column to provide additional program information.

High 5 (Alabama)

Design Overview

To test the effectiveness of the High 5 intervention, a randomized experimental design was used in which 28 elementary schools were paired within each of three school districts (Harrington et al., 1997; Reynolds et al., 1998; Reynolds et al., 2000). Pairings were based on the school's racial/ethnic composition and on the proportion of students receiving free or reduced-price meals. One school from each pair was randomly assigned to an intervention condition and the other to a usual-care control condition. Schools randomized to control status were provided with the High 5 intervention after the final followup assessment. Sixty-nine percent of eligible families were recruited for the study. More than 1,300 parents and nearly 1,700 students participated. Each student and one of his or her parents completed assessments at baseline and at 1 and 2 years after baseline. The baseline assessment was completed at the end of the third grade, the intervention was delivered in the fourth grade, and booster sessions were delivered in the fifth grade. Vegetable and fruit consumption was assessed using a 24-hour recall method in children and the Health Habits and History Food Frequency Questionnaire in parents (Block et al.,

1990). Cafeteria observations were conducted on a subsample of the children. Psychosocial variables were selected using Social Cognitive Theory as a guide (e.g., perceived self-efficacy and outcome expectancies), and then were assessed in children and parents using self-administered questionnaires. Followup assessments were completed at the end of the fifth grade on 89 percent of participants who completed baseline assessments.

Use of Theory in Intervention Design

The intervention had three components—classroom, food service, and parents—that targeted theoretical constructs within Social Cognitive Theory (Bandura, 1986). This theory proposes that behavior, personal factors, and environmental influences all interact as determinants of one another. The specific constructs from Social Cognitive Theory that were used to design the intervention included observational learning, goal setting, self-monitoring, reinforcement, behavioral capability, outcome expectations, perceived self-efficacy, and environment. The components of the theory and examples of their relationship to the intervention are presented in Table 3 and in greater detail by Reynolds and colleagues (1998). Each construct within Social Cognitive Theory was used in the design of the High 5 intervention. The theory was mapped on the specific problem of increasing vegetable and fruit consumption in the target population. Intervention components were then developed to manipulate each of the constructs of the theory and, in turn, to produce changes in vegetable and fruit consumption. For example, goal setting and self-monitoring are indicated as ways in which individuals will identify behavioral targets and work toward completion of the target behavior. Individuals who set goals and monitor their progress are much more likely to make changes in their target behavior. In the High 5 intervention, these principles were used by having families set a goal of eating five servings of vegetables and fruit on a specific day in the coming week. Simple worksheets and other self-monitoring tools were then supplied to help families track their progress toward completion of the goals. This intervention process was repeated with activities developed to: 1) alter the environment to support vegetable and fruit consumption, 2) increase positive and reduce negative outcome expectations for eating vegetables and fruit,

3) improve the behavioral capability for eating vegetables and fruit, 4) use goal setting and self-monitoring for key skills and behaviors, 5) reinforce participants in reaching goals, 6) use observational learning principles to teach key skills and perceptions, and 7) increase perceived self-efficacy for vegetable and fruit consumption.

Intervention Description

The learning methods used in the 14-lesson classroom component included modeling, self-monitoring, problem-solving, reinforcement, and taste-testing. Consistent and memorable characters (e.g., Indiana Banana) were used, and the name Freggie (an amalgam of fruit and veggie) was attached to activities for easy recognition. For example, the *Freggie Book* contained homework. The program was taught by nine curriculum coordinators (employed by the High 5 project) who were trained both to deliver the semiweekly classroom lessons and to coordinate food-service and parent activities. Two lessons were taught every week for 7 weeks. The curriculum was delivered on 3 consecutive days each week, with a 30- to 45-minute lesson presented on the first day, a High 5 Day observed on the second day in which all children set the goal of eating five servings of vegetables and fruit, and a 30- to 45-minute lesson delivered on the third day. The lessons had common elements to provide consistency across all 14. For example, each lesson had a checkup section to review information from earlier lessons and a learning-activity section to build skills, self-efficacy, and outcome expectations, as well as to alter food preferences. Classroom activities included undertaking role-playing to improve both vegetable and fruit preparation and asking skills, awarding individual and class points for reaching goal behaviors, reading stories to increase beliefs about the positive outcomes of eating more vegetables and fruit, and conducting taste-testing events to increase preferences. On each High 5 Day, students were challenged to eat five servings of vegetables and fruit and then to record their consumption on a food record. Parents were alerted and asked to help their children have a High 5 Day, and they also were encouraged to eat five servings of vegetables and fruit.

For the parental involvement component, parents received an overview of High 5 during a kick-off night held at each school at the beginning of the intervention. Parents were asked to encourage and

support behavioral change in their child and to complete the *Freggie Book*, which contained seven homework assignments (Freggie Lessons) to be performed by the parents and their children. It also contained brochures, skills-building materials (e.g., recipes), and other items (e.g., refrigerator magnets) to trigger the desired behavior. Parents were asked to complete one interactive Freggie Lesson with their child each week for 7 weeks and to indicate completion using a signed voucher, which would be returned to the classroom for prize drawings. For example, parents and children worked together to identify preferred vegetables and fruit and to develop a shopping strategy to buy these food items.

For the cafeteria intervention component, food-service managers and workers received a half-day of training on purchasing, preparing, and promoting vegetables and fruit that met the High 5 guidelines. Food-service managers received a calendar outlining intervention tasks. Each cafeteria was rated monthly and given 2, 3, or 4 stars based on its completion of 10 intervention activities (e.g., offering at least 10 vegetable and fruit servings per week). The 10 activities were worked on over a period of 4 months, but some activities were designed to coincide with the 7-week classroom curricula and homework assignments (e.g., help with taste-testing in the classroom). Project nutritionists determined monthly “star status.” Food-service workers received guidance on purchasing, preparing, and promoting vegetables and fruit during regular visits by High 5 nutritionists, and each four-star cafeteria received a star-rating certificate to provide feedback and reinforcement.

OVERVIEW OF RESULTS

The immediate posttest effects of all five State intervention projects on the main outcome of vegetable and fruit consumption are summarized in Table 4. Schools served as the units of analysis in all projects except California, where individual students were used as the units of analysis. In all five projects, significant effects were observed on the main outcome variables of combined vegetable and fruit consumption, or vegetable and fruit consumption examined separately. Effects favoring the intervention condition were found on

combined vegetable and fruit consumption rates in Georgia, Louisiana, Alabama, and California. Minnesota and Alabama found significant effects favoring the intervention condition on fruit consumption, while Georgia and Alabama found significant effects on vegetable consumption. These differential effects across projects may be due to the design of the interventions and the emphasis placed on vegetable versus fruit consumption. Differences also might be due to different delivery intervals of the vegetable versus fruit sessions designed for each project, with more faithful delivery of fruit activities in Minnesota and vegetable activities in Georgia; differences also might be due to regional variances in the availability and preferences for vegetables versus fruit.

SUMMARY AND LESSONS LEARNED

Program Effectiveness

A number of factors facilitated the successful completion and outcomes of these 5 A Day projects. First, cooperation with schools, school districts, and other community agencies was essential to the fulfillment of project activities, including recruitment and completion of interventions and measures. Those planning a school-based 5 A Day effort are strongly advised to build strong school and community collaborations early in the development of the project. Second, each of the interventions was designed using one or more models of behavior change. This theory-based approach is likely to produce more effective nutrition interventions (Contento et al., 1995) and may partially account for the effects observed in the 5 A Day school-based interventions. Third, each of the interventions used a multiple-channel intervention approach that included the classroom, food-service personnel, and families. The California project also utilized broader community-intervention activities in the school-plus-community condition. Multicomponent interventions are likely to be more effective than those targeting only one intervention component and may help account for the significant differential effects found in the 5 A Day school-based programs. However, the multicomponent approach is also more difficult to design and implement. Because

Table 4. Immediate Post-Test Program Effects on Daily Vegetable and Fruit Consumption

Project	Experimental Condition	Total Vegetables and Fruit ¹		Fruit ²		Vegetables	
		Mean	p-value	Mean	p-value	Mean	p-value
5 A Day Power Plus (Minnesota)	Treatment Control	5.24 4.66	NS	2.75 2.13	0.02	2.50 2.52	NS
5 A Day Power Play! (California)	School plus community	3.3	0.05	-	-	-	-
	School only	2.9		-		-	
	Control	2.3		-		-	
Gimme 5 (Georgia)	Treatment	2.3	0.05	1.1	NS	1.2	0.01
	Control	2.1		1.1		1.0	
Gimme 5 (Louisiana)	Treatment	3.0	0.05	-	-	-	-
	Control	2.6		-		-	
High 5 (Alabama)	Treatment	3.96	0.0001	1.71	0.0001	1.84	0.0001
	Control	2.28		0.83		1.15	

KEY: NS = not significant.
- = not available.

¹ Includes vegetables, fruit, and 100 percent juice
² Includes fruit and 100 percent juice

of these difficulties, school health professionals may wish to use an established 5 A Day multi-component program with demonstrated behavior change properties and outcomes rather than develop a new program.

Each of the interventions described in this chapter was designed for a broad target audience, and each has broad applicability in diverse school-based settings. None of the interventions targeted specific ethnic or socioeconomic subgroups. Because a general approach was used, some effectiveness in producing dietary change in ethnic, socioeconomic, and other subgroups may have been lost. Future studies might target these subgroups in an effort to increase the effectiveness of the projects.

Among these studies, California, Georgia, and Minnesota utilized existing classroom teachers to deliver their interventions, Louisiana used a mix of classroom teachers and project staff, and Alabama used only project staff. Alabama produced large and significant effects and might be considered an efficacy trial where the intervention is delivered under optimal conditions and where program implementation, availability, and acceptance are

controlled as much as possible (Flay, 1986). Future testing will determine the effectiveness of the program when taught by existing classroom teachers. As noted, the other programs used school personnel to deliver the interventions, resulting in lower experimenter control over program availability and acceptance and somewhat weaker effects on the outcome. However, the significant outcomes of even these programs suggest that they were efficacious and that they produced these effects despite lower experimenter control over program availability and acceptance. Consideration now might be given to the best means of disseminating these programs and further strengthening the outcomes. Further consideration also should be given to the best means of training and delivering the interventions to school teachers and community personnel so that the programs will be maximally effective when delivered by these individuals. In many settings, innovative ways of integrating nutrition into reading, math, and social studies lessons may be required to enlist teacher cooperation.

Four of the five projects described in this chapter targeted elementary school children. Thus, the

strongest conclusions can be drawn about the effectiveness of 5 A Day school-based interventions for this age group, although important conclusions can be drawn about high school students as well. Future studies are needed to determine the best methods for reaching middle school students. Useful lessons can be learned from both the elementary and high school interventions, and these lessons can be used in the design of the middle school programs.

A cautionary note should be added about generalizing the results and experience of the 5 A Day interventions to other school-based nutrition programs. The 5 A Day interventions found positive effects for relatively intensive interventions that were mounted with substantial monetary, school, and community support. Not all school-based programs will be able to marshal these resources and, as a result, may have more limited success. Schools also have barriers that must be overcome to produce effective nutrition interventions. For example, schools have a limited amount of time to devote to nutrition programs, and many school districts are focusing on basic academic subjects, limiting access for nutrition intervention. The 5 A Day interventions were able to overcome these barriers by working closely with interested, participating districts. Finally, the long-term effectiveness of the 5 A Day school-based interventions has not been firmly established, and their effects may erode over time. Repeated interventions may be required to ensure dietary change over an extended period of time when using these or other school-based nutrition interventions.

Evaluation Issues

Strong evaluation designs were used to assess the 5 A Day school-based interventions, leading to strong conclusions about the effectiveness of the programs. The designs used school as the unit of assignment, the matching of schools prior to randomization, appropriate comparison groups, and attention to hierarchical design issues in the analysis of the evaluation data. In addition, four of the State projects randomly assigned schools to conditions. The designs used in these projects allowed the projects to establish the causal effectiveness of the interventions at producing changes in vegetable and fruit consumption among youth. Investigators in future 5 A Day projects are encouraged to apply the highest level

of methodological rigor possible in their evaluation designs. This will help establish a clear understanding of which intervention approaches are most effective with children and adolescents.

None of these designs allowed the investigators to identify the specific intervention subcomponents (e.g., food-service changes) that produced the best overall intervention effects. Studies that systematically vary individual intervention components will be needed to identify the components that are most effective in producing increases in vegetable and fruit consumption. Although potentially important, such studies are rarely conducted due to costs and other practical considerations. As stated earlier, it is also likely that multicomponent interventions are more effective than single-component (e.g., classroom only) interventions. Alternatively, analyses can be conducted to identify the significant mediators for effective programs (MacKinnon, 1994), often referred to as mediational analysis. This approach tests the constructs of the theoretical model used to design the program in order to identify those constructs that account for the effectiveness of the program. If this mediational analysis approach were used consistently by intervention researchers in project design and data collection, interventions to modify vegetable and fruit consumption could be made more effective and less cumbersome by using only those constructs shown in prior studies to have produced positive intervention effects.

All five studies provided a strong assessment of diet, with the 24-hour dietary recall being the most frequently used assessment tool because of its accepted validity in children of this age range. The single-recall approach used in these studies yields a valid assessment for group comparisons to test the effectiveness of the interventions. One project (Georgia) used a 7-day food record, which yielded both a valid estimate of vegetable and fruit consumption for group comparison and also a more stable estimate of individual consumption of vegetables and fruit by the children.

Lessons Learned

Many practical lessons were learned while conducting these studies. Interventions should focus on the interests and motivations of the targeted youth to ensure their active participation. Formative data collection (e.g., focus groups) may be required to determine the specific interests of

the target group. Taste-testing was a popular intervention activity for both elementary and high school students. However, taste-testing activities take substantial effort to mount, and school food-service participation will vary substantially among schools. School food-service personnel care about the nutritional lives of the students and can be enlisted as allies in the program, if given specific and valued responsibilities. Games and contests work well as intervention strategies with adolescents. Parents are reluctant to attend intervention activities at the schools, although participation can be increased if program activities are linked to existing school activities, such as Parent-Teacher Organization meetings. Social reinforcement (e.g., public recognition for reaching a goal) and group contests leading to reinforcement can be very effective strategies in these programs. It is possible to add community intervention components (e.g., media and farmers markets), and these may increase the effectiveness of a program. Classroom time is limited for intervention activities. Therefore, further design and testing of environmental interventions may be warranted. Recruitment of lower socioeconomic group participants is more difficult and may take innovative strategies, such as followup calls and direct personal contacts with parents. Self-report questionnaire assessments are best completed by children in the classroom and by use of two-person data collection teams.

FUTURE DIRECTIONS

These trials demonstrate that school-based interventions can be used to produce increases in vegetable and fruit consumption among children and adolescents. There is a need for further work on programs for middle school children and for children in kindergarten through the third grade, as well as in the sixth grade, and on strengthening the effects produced by these interventions. In particular, improvements are needed in the parental and environmental components and in creation of interventions that are specifically tailored to various ethnic groups. It also would be beneficial to integrate nutritional and physical activity interventions in the school setting. The fidelity of interventions might be improved with increased self-efficacy of teachers to enlighten

children about nutrition and through the use of interactive teaching techniques, such as classroom food preparation. The continued use of the theory-based approach is encouraged to improve understanding of the factors that affect eating behaviors.

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